

## REMARKS/ARGUMENTS

Applicants acknowledge receipt of the Final Office Action dated January 17, 2007. Claims 1-10 and 15-16 are currently pending in the application. Please note that claim 1 is an independent claim. Further, claim 1 has been amended. Claims 7-14 have been canceled. In the Office Action, the Examiner objected to the Specification under 35 U.S.C. § 112 for written description. The Examiner also rejected claims 1-6 and 15-16 under 35 U.S.C. § 112, first paragraph for enablement. Applicants believe all pending claims are allowable and respectfully request reconsideration and allowance of all claims.

### I. Information Disclosure Statement

Applicants have submitted copies of all references listed in the Specification in a Supplemental Information Disclosure Statement. These references and additional references will be discussed in more detail below.

### II. Specification

The Examiner has maintained the objection to the Specification under § 112 as not containing “a written description of the invention . . . in such full, clear, concise as to enable any person skilled in the art . . . to make and use the same.” The Examiner states that the Specification does not provide examples of calculations such as the band structure of the crystal, wave vectors in 3D space, dispersion surface, etc.

According to the Manual of Patent Examining Procedure (hereinafter “*MPEP*”), enablement is “a determination of whether that disclosure, when filed, contained sufficient information regarding the subject matter of the claims as to enable *one skilled in the pertinent art* to make and use the claimed invention.” *MPEP* § 2164.01 (emphasis added). Furthermore, “a patent need not teach, and *preferably omits*, what is well known in the art.” *Id.* (citing *In re Buchner*, 929 F.2d 660, 661, 18 USPQ2d 1331, 1332 (Fed. Cir. 1991); *Hybritech, Inc. v. Monoclonal Antibodies, Inc.*, 802 F.2d 1367, 1384, 231 USPQ 81, 94 (Fed. Cir. 1986)).

Applicants respectfully reiterate that the calculations which concern the Examiner are known to persons of skilled in the art of photonic crystals and optics. To support this assertion, Applicants direct the Examiner’s attention to the published reference entitled, “The Superprism

Phenomenon in Three-Dimensional Macroporous Polymer Photonic Crystals,” listed in paragraph [0026] of the Specification. Prasad et al., 67 Physical Review B 165103-1 (2003) (hereinafter “*Prasad*”). The *Prasad* reference, which is incorporated into the Specification by reference, provides more information on the calculations which were described in the Specification. Specifically, *Prasad* indicates that “[t]he band structure for the macroporous polymer is calculated using an available software package.” *Id.* at 165103-2.

Applicants, thus, also refer the Examiner to the following web address, [http://ab-initio.mit.edu/wiki/index.php/MIT\\_Photonic\\_Bands](http://ab-initio.mit.edu/wiki/index.php/MIT_Photonic_Bands), to show that the software, MPB, is freely available over the Internet to enable one of skill in the art to perform the “rigorous calculations” necessary to enable the claims. In particular, MPB allows a person of ordinary skill in the art to calculate the full band gap structure of a photonic crystal including all possible values of the wave vectors in 3D space. Once the values of the wave vectors in 3D space have been determined, the dispersion surface may be found simply by plotting the wave vectors in a three dimensional plot as shown in Figure 3 of the Specification. *See also* Specification at ¶ [0024]. Additional details on determining propagation direction are found in the *Prasad* reference. *See Prasad* at 165103-2. And more details can be found, in fact, in the 1999 *Kosaka* reference entitled, “Superprism Phenomena in Photonic Crystals: Toward Microscale Lightwave Circuits” (hereinafter “*Kosaka*”), which the Examiner has provided. It is clear from the *Kosaka* reference, that determining propagation direction from a dispersion surface was well known before the time of filing.

Furthermore, Applicants are submitting an additional reference dated January 2001 (before the filing date of the pending application) in the supplemental IDS which clearly shows that the necessary calculations, algorithms, and methods used in MPB were well known in the art at the time of filing. *See* Johnson et al., “Block-iterative frequency-domain methods for Maxwell’s equations in a planewave basis,” 8 Optics Express 173 (2001). From the perspective of a layperson, the calculations laid out in the Specification and the prior art may seem “rigorous.” However, the enablement standard is applied from the perspective of one of ordinary skill in optics and photonic crystals. *See* MPEP §2164.01. In view of the references cited in the Specification and submitted in the IDS, it is apparent that to such a person, the “rigorous calculations” are not “rigorous” or undue, but instead are merely routine. As such, Applicants

respectfully submit that the Specification in view of the state of the art contains a fully enabling description of the invention and respectfully request withdrawal of the objection.

### **III. Claims 1-6 and 15-16 are enabled.**

The Examiner has rejected claims 1-6 and 15-16 under 35 U.S.C. § 112, first paragraph for failing to comply with the enablement requirement. In particular, the Examiner provides several reasons for the rejection including among other reasons, the breadth of the claims, insufficient disclosure to construct the sensor, lack of examples, and undue experimentation. Applicants address each reason below and respectfully traverse the rejection.

#### ***A. The Breadth of the Claims***

The Applicants respectfully submit that the claims, as they currently stand, are not overly broad nor are they unclear. Firstly, the Examiner questions the breadth of such limitations such as “an angle” and “a wavelength.” Applicants understand that a light beam always has a wavelength and the beam will always be emitted at an angle. Applicants respectfully point out that these limitations provide antecedent basis for later dependent claims i.e. claim 6. Furthermore, the mere fact that such limitations are broad provides no basis for an enablement rejection. Nevertheless, claim 1 has been amended to further clarify the invention. Applicants believe this amendment should address the Examiner’s concerns regarding the limitations.

Secondly, the Examiner states that “[i]t is not quite clear, which change in the position is meant in the claim, since the change has to be measured relative to some reference value.” With regard to the limitation “change in position,” Applicants submit that one of ordinary skill in the art would not find this limitation to be unclear. A change in position is typically measured from two points i.e. measuring the movement of something from point A to point B. As is well known in the art, a position sensing detector is a device for measuring a change in beam position. *See* Specification at ¶ [0037]. Therefore, one skilled in the art would not find the term “change in position” unclear. In addition, whether the limitation “change in position” is unclear has no bearing on enablement of the claims. The limitation “a position sensing detector for detecting a change in the position of the light beam” is fully enabled by the Specification as seen in paragraphs [0014] and [0037].

**B.     *The Nature of the Invention***

The Examiner here classifies the sensor as an invention based upon theoretical models and requiring “rigorous calculations.” Applicants have addressed the “rigorous calculations” allegation in detail in Section II as well as in Sections IIIC-D, *infra*. With respect to the invention based upon theory, the fact that an invention has not been reduced to practice does not mean that it is not enabled. *See, e.g., MPEP* § 2164.02. Specifically, the *MPEP* expressly states “[t]he mere fact that something has not previously been done clearly is not, in itself, a sufficient basis for rejecting all applications purporting to disclose how to do it.” *Id.* (citing *Gould v. Quigg*, 822 F.2d 1074, 1078 (1987)). Accordingly, the nature of the invention here is not a conclusive factor in determining whether the Specification is enabling.

**C.     *The State of the Prior Art***

As explained in Section II of this Response, the prior art fully sustains the assertion that the pending claims are enabled by the Specification. In addition, the *Kosaka* reference cited by the Examiner provides a complete description of how to determine propagation direction from a dispersion surface. *See, e.g., Kosaka* at 2035-36. With respect to the other cited reference, Applicants fail to see the relevance of the obviousness argument with respect to enablement. If anything, the Examiner’s statement that “no experimental data are found in the prior art” only further reinforces the novelty and non-obviousness of the pending claims. Likewise, the state of the prior art only reinforces the fact that the calculations and methods described in the Specification fully enable the claims.

**D.     *Level of One of Ordinary Skill and the Amount of Direction Provided by the Inventor***

The Examiner further states that “[t]he specification does not provide an adequate disclosure for any person of ordinary skill in the art to construct the sensor recited in the claims.” Specifically, the Examiner points out that “any change in the refractive index of the crystal material will lead to change in this angle, whether this is an analyte or any unknown impurity in the solution.” Applicants submit that the Specification provides a sufficient disclosure such that one of ordinary skill in the art could construct a sensor as recited in the claims.

In light of the Examiner's statements regarding the refractive index of the crystal and impurities, it appears that the Examiner has misunderstood how the claimed sensor functions. Applicants respectfully refer the Examiner to Figure 1 of the Specification. As solution 50 flows through the photonic crystal 10, a particular analyte may bind to the photonic crystal through a binding moiety or by other means. The photonic crystal is, thus, specific to the analyte. As such, the refractive index of the crystal will only change when the analyte binds to the photonic crystal material. Other impurities or compounds will not bind to the crystal 10. If the solution 50 does not contain the analyte in question, the refractive index of the photonic crystal will not change, and consequently, the position of the light beam emitted from the photonic crystal will not change. Accordingly, the refractive index of the photonic crystal will not change in the presence of any and/or all impurities. To the contrary, the refractive index will only change in the presence of the analyte.

As to the issue of whether one of skill in the art could construct such a sensor, Applicants refer Examiner to Jiang et al. (hereinafter "*Jiang*"), incorporated by reference into the Specification, which provides detailed guidance on how to fabricate photonic crystals with the desired band structure. See Jiang et al., "The Fabrication and Bandgap Engineering of Photonic Multilayers", 13 Advanced Materials 389, 393 (2001). In fact, a recent article (published *after* the filing date of the application) describes the fabrication of a photonic crystal exhibiting the superprism effect based upon Applicants' theoretical calculations. Serbin and Gu, "Superprism Phenomena in Waveguide-Coupled Woodpile Structures Fabricated by Two-Photon Polymerization," 14 Optics Express 3563 (2006).

Moreover, in view of the complexity and depth of the prior art as shown in Section II, it is also apparent that the level of skill found in persons knowledgeable in the art is very high. The Federal Circuit has expressly "held that [a] specification was enabling with respect to the claims at issue and found that 'there was considerable direction and guidance' in the specification; there was '*a high level of skill in the art at the time the application was filed*;' and 'all of the methods needed to practice the invention were well known.'" MPEP § 2164.01 (citing *In re Wands*, 858 F.2d 731, 740 (Fed. Cir. 1988)) (emphasis added). Accordingly, in light of the level of one of ordinary skill, the Specification provides more than enough guidance to construct the invention and thus, provides a fully enabling disclosure.

**E. The Existence of Working Examples**

The Examiner also points out that “[n]o working examples for the sensor . . . are provided in the claims.” Applicants assert that the lack of working examples cannot be a sufficient basis for an enablement rejection. Specifically, the *MPEP* stresses that “[c]ompliance with the enablement requirement of 35 U.S.C. 112, first paragraph, does not turn on whether an example is disclosed.” *MPEP* § 2164.02. Furthermore, in view of the extensive literature on how to perform the necessary calculations, as explained above, inclusion of numerous examples would be redundant and unnecessary. “[N]ot everything necessary to practice the invention need be disclosed. In fact, what is well-known is best omitted.” *MPEP* § 2164.08 (citing *In re Buchner*, 929 F.2d 660, 661 (Fed. Cir. 1991)).

The Examiner additionally states that only examples provided are based on theoretical models. However, the *MPEP* also specifically states that an example may be a working example or a prophetic example. For example, the *MPEP* notes “[a] prophetic example describes an embodiment of the invention based on ***predicted results*** rather than work actually conducted or results actually achieved. An applicant need not have actually reduced the invention to practice prior to filing.” *MPEP* § 2164.02 (emphasis added). As such, Applicants submit that the absence of working examples in the Specification is not a sufficient basis for an enablement rejection.

**F. The Quantity of Experimentation**

In view of the Section II and the reasoning laid out above, it is plain that one of skill in the pertinent art (i.e. optics and photonic crystals) would be fully aware of the calculations and methods described in the Specification. As stated in the *MPEP*, “‘The test is not merely quantitative, since a considerable amount of experimentation is permissible, if it is merely routine, or if the specification in question provides a reasonable amount of guidance with respect to the direction in which the experimentation should proceed.’” *MPEP* § 2146.06 (citing *In re Wands*, 858 F.2d 731, 737 (Fed. Cir. 1988)). Applicants submit that the description of the sensor and the calculations described in the Specification provide a reasonable amount of guidance to one of skill in the art. As explained in Section II, the necessary calculations i.e. band gap

structure, dispersion surface, would be a matter of routine experimentation to a person of skill in the art. The actual fabrication of the photonic crystal would also involve routine experimentation as the techniques to make such a crystal were already known in the art. *See, e.g., Jiang* at 293. Consequently, Applicants submit that only routine experimentation would be required to make or use the invention in view of the Specification.

For all of the reasons discussed above, Applicants assert that the pending claims are fully enabled by the Specification from the perspective of one of skill in the art. As such, Applicants respectfully request withdrawal of the rejection and allowance of the claims.

### CONCLUSION

Applicants respectfully request reconsideration, allowance of the pending claims and a timely Notice of Allowance be issued in this case. If the Examiner feels that a telephone conference would expedite the resolution of this case, the Examiner is respectfully requested to contact the undersigned.

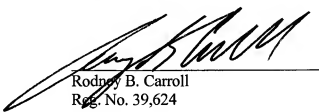
In the course of the foregoing discussions, Applicants may have at times referred to claim limitations in shorthand fashion, or may have focused on a particular claim element. This discussion should not be interpreted to mean that the other limitations can be ignored or dismissed. The claims must be viewed as a whole, and each limitation of the claims must be considered when determining the patentability of the claims. Moreover, it should be understood that there may be other distinctions between the claims and the prior art that have yet to be raised, but which may be raised in the future.

If any fees are inadvertently omitted or if any additional fees are required or have been overpaid, please appropriately charge or credit those fees to Conley Rose, P.C. Deposit Account Number 50-1515.

Respectfully submitted,  
CONLEY ROSE, P.C.

Date: \_\_\_\_\_

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